DOCUMENT RESUME

ED 223 993 CS 006 922

AUTHOR Grocke, Margaret
TITLE Interactive Development of Reading Skills in an Educational Clinic.
PUB DATE Sep 82
NOTE 20p.; Paper presented at the Annual National Conference of the Australian Group for the Scientific Study of Mental Deficiency (18th, September 1982).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Elementary Education; Foreign Countries; Program Descriptions; Program Evaluation; Reading Attitudes; *Reading Comprehension; *Reading Difficulties; *Reading Improvement; *Reading Instruction; Reading Skills; *Sight Vocabulary; Vocabulary Development
IDENTIFIERS Australia

ABSTRACT

Computer-based reading programs have been used at the City Educational Clinic in Canberra, Australia, to improve the reading skills of children who are "reading disabled." Children interacted with the computer via a graphic display, touch sensitive screen, and synthesized speech. The first program taught a basic sight vocabulary and allowed children to construct their own sentences from word lists. A modified cloze procedure was used in the second program, in which the child chose the missing word in a paragraph from a number of alternatives presented. If the child could not read a word in the displayed paragraph, he or she could have it spoken by the computer. Spoken or visual feedback was given to all the child's responses. Reports from classroom teachers indicated that the program improved self-confidence and interest in reading for many children. Important motivating factors included a program design in which the child could experience success and which provided immediate and explicit feedback. Evaluation studies indicated significant gains in sight vocabulary and reading comprehension scores after 4 to 5 hours of computer-based instruction. (HTH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED223993

Interactive Development of Reading Skills in an Educational Clinic

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Margaret Grocke

Department of Engineering Physics

Australian National University

Computer-based reading programs have been used at the City Educational Clinic in Canberra to improve the reading skills of children who are 'reading disabled'. Children interacted with the computer via a graphic display, touch sensitive screen and synthesized speech. A sight-word recognition program taught a basic sight vocabulary and allowed children to construct their own sentences from word lists.

A modified 'cloze' procedure was used in the second program. The child chose the missing word in a paragraph from a number of alternatives presented. If the child could not read a word in the displayed paragraph, he/she could have it spoken by the computer simply by pressing a 'help' button and then pressing on the unknown word. Spoken and/or visual feedback was given to all the child's responses. This program helped teach strategies which could be applied in reading. For example, the child learned to 'guess' unknown words by using semantic and syntactic cues.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Margaret Grocke

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CS006922

Reports from classroom teachers indicated that the program improved self-confidence and interest in reading for many children. Important motivating factors included a program design in which the child could experience success, and which provided immediate and explicit feedback.

In evaluation studies, significant gains in sight vocabulary and reading comprehension scores were obtained after four to five hours of computer-based instruction. The results of these studies are discussed, together with the reactions of children, educators and parents.

Introduction

Independence in reading depends on the child's ability to use context, to recognize salient features of a sufficient number of words to provide the basis of a reading vocabulary and to utilize graphemic and phonetic cues (Clay, 1979). The most important test for the child is "Does it make sense?" Children with reading problems may have difficulty with one or more of these skills. They may be unable to decode words or use context cues, for example, and have difficulty focussing on the relevant features of the task. Because of the heterogeneity of the population, and erratic performance of some children with reading problems, no one method of teaching has been found to be universally successful.

Computers have allowed new modes of learning to be introduced to education. Although some reviews have suggested that computer-based instruction has not developed to its full potential, computer-based instruction as a supplement to classroom instruction has been shown to be more successful than classroom instruction alone (Alderman et al, 1978, Edwards et al, 1975). Computer-based instruction has been found to be relatively more effective with less educationally affluent, less achievement oriented students and those with lower IQs (Kearsey, 1977). On attitude scales students saw the computer more positively than teachers or textbooks, rating it as more competent, trustworthy and having more charisma. It was suggested that computer-based instruction holds no prior expectations or biasses which can lead to poorer performance. Computer-based instruction may therefore be more effective with underprivileged or handicapped populations.

Children with learning problems have more difficulties attending to the relevant features of the learning task. One characteristic of their reading is a high number of reversals. They may not attend to the fact that the sequential order of letters is important, for example, or attend to the shape and orientation of letters. Children with learning problems need more reinforcement of new learning and benefit from a structured approach, which gives a child the opportunity for extensive practice and provides immediate feedback (Bateman, 1979). Southgate (1981) in her review of extending beginning reading noted that the requisites for success in reading include that the child should be motivated to read, the process should be pleasant and satisfying for the child, the level of difficulty of

the task should provide a strong possibility of success and there should be an opportunity for practice at each level. An advantage of computer-based instruction is that consistent feedback is provided and programs can be structured so the chance of failure is minimised. Material which is not know or produces a high error rate can be automatically repeated. The child can therefore learn in a structured situation at his/her own pace.

The Department of Engineering Physics at the A.N.U. is investigating ways in which computers can be used to improve basic skills of intellectually handicapped children and who have learning problems. Computer-based instruction is used to supplement regular classroom instruction. Lally (1981) found a significant improvement in the number of sight words recognized by mildly intellectually handicapped children after five hours of computer instruction. Using digitized speech to communicate instructions, the children were taught a basic sight vocabulary of 105 words. Word-arrays of 16 words were placed over a four by four matrix of 16 large back-lit buttons. The computer instructed the child to press a word, for example "Press house". After a correct response the button lit up and the computer repeated the word three times. If the child made an error, the computer responded, "You got horse, try again, press house." Visual cues, by flashing the light under the button, were given if the child did not respond within five seconds or had already made one error. New words were only presented after a correct response. Results of a training program showed significant improvements in sight vocabularies. The number of words recognised by the training group

increased from an average of 38.5 to 68.6, while the improvement in a comparison group was 37.5 to 42.6 words. Long term gains were assessed and the average number of words recognised by the training group 26 weeks later was 70.9 while the comparison group scored 47.2. Advantages of the program included consistency of feedback and monitoring of errors. A word was reproduced in exactly the same way each time and the child could not be distracted by changes in pronunciation or tone. Errors were re-presented so the child would work on a subset of words he/she did not know, until these were recognised correctly. The 'spoken' feedback meant the child could work independently with the computer as he/she did not have to read instructions or be able to type or spell answers. One limitation in this study was that each overlay of sixteen word had to be changed by the experimenter. Use of a touch sensitive display screen improves this as overlays can be selected from a menu by touching the appropriate box on the screen. With this improvement, the sight word program was implemented at the City Educational Clinic using a touch sensitive display. The program was also extended to allow the child to build his/her own sentences from word lists.

The sight vocabulary program taught basic sight words and gave the children practice using the words in context by building sentences. To be independent in reading a child needs an adequate sight vocabulary to be able to recognise many words automatically, and needs at least one other strategy to help work out unknown words. The more strategies a child has available the better chance of success. Use of contextual cues is an important skill in reading. A second

program implemented at the Clinic used a modified cloze procedure. This procedure focussed attention on the use of syntactic and semantic cues. The approach is based on the premise that the child can discover for him/herself how to utilize contextual cues and strategies in reading. The cloze program presented the child with stories on the screen, with one word missing from each passage displayed. The child could choose the correct word from a group of four words displayed at the top of the screen. Visual and spoken feedback was given after each response. The programs implemented at the City Educational Clinic are described, together with the results of evaluation studies.

Equipment:

A DEC PDP-11/03 computer was used for instruction at the Educational Clinic. The children interacted with the program via a graphic display, a touch sensitive display screen (TSD) and a Votrax VS/B speech synthesizer. The touch sensitive screen was mounted on a set of micro switches, which indicated if the child had responded by pressing on the screen. Acoustic waves were used to determine the position of the child's finger on the screen (256 by 256 matrix). The voice synthesizer had 63 phoneme commands which could be combined and used with four levels of speech inflection. The phonemes were optimized for a Mid-west American English dialect.

SIGHT WORD PROGRAM

Subjects:

Thirteen children were referred to the program during the summer vacation by remedial reading teachers and school counsellors in primary schools. There were 12 males and one female. Chronological ages ranged from 7 years and 3 months to 11 years and 10 months, and IQ scores were in the average to superior range (I.Q > 85). Selection was based on the following criteria:

a) the children recognized less than 90 per cent of the words from the Dolch Sight Word list.

b) the children were reading at a level at least one year below their chronological age.

The children were pre- and post-tested on the ACER sight vocabulary test, the Dolch list and the Neale Comprehension test. Words taught came from the Dolch sight word list and a list of common words chosen by the children for constructing sentences.

A comparison group of seven children tested during the school term received regular classroom instruction and were given the pre-tests and post-tests four weeks later.

Instructional Procedure:

The children received a total of four hours of computer instruction over a period of four weeks (three individual 20 minute sessions weekly). There were two parts in the program. The first taught a basic sight vocabulary and the second allowed children to build their own sentences from word lists.

Part 1: Sight Words

The child selected one of 24 word-arrays by pressing the appropriate numbered box on the screen. A 5 by 3 box matrix of 14 words, plus a 'NEXT' command was then displayed on the screen. The child could have any of the words 'spoken' by pressing the word on the screen and could choose to proceed to the next phase by pressing the 'next' position. The computer started by saying "Hi there, (Child's name)". On each of the 14 trials the child was instructed to press 'x' (where 'x' was a word on the screen). If the child pressed the correct word the box was outlined and the word repeated three times. If the choice was incorrect, the computer responded "You got 'y', try again, press 'x'". New words were presented only after a correct response. Errors were re-presented after an incorrect response. A visual prompt was given if the child did not respond within a given time period (specified at the beginning of the program). At the end of the trials the child was told the number of correct responses in the form: "Good work, you got twelve out of fourteen - to try again press 'next'."

Part 2: Sentence Construction

Children built their own sentences from words listed on the screen. To obtain an alphabetical listing of words, the child pressed the appropriate letter from the menu. The list of words beginning with that letter then was written on the screen. Several function words allowed the child to erase words (erase), proceeded to a new word-array (new) or end the file (endFILE). A full-stop could be added by pressing the 'next' position (see figure 1). The word chosen appeared at the top of the screen and the incompleted sentence was 'read' to the child, so the child received immediate feedback in print and sound. The completed sentence, after inclusion of a full-stop, was 'read' to the child and printed on the line printer.

Figure 1: The TSD Screen for sentence building

I catch yabbies in the		
new	erase	endFILE
creek	can	next
computer	city	catch
climb	cry	car
children	camp	cold
cat	call	cut

Results:

To assess differences in performance on pre- and post-tests a group of seven children was selected from the training group, matched with the comparison group on age and pre-test scores. T-Tests applied showed no significant differences between the two groups on pre-test scores. Two-way analyses of variance (Group x Test) with repeated measures showed a significant interaction effect between group and test on all three tests, indicating that the training group scored significantly higher than the comparison group on the post-tests. (Dolch sight words: $F(1,12) = 6.54$, $p<.05$, ACER scores: $F(1,12) = 14.84$, $p<.01$, Neale comprehension scores, $F(1,12) = 5.65$, $p<.05$). Mean scores are presented in Table 1.

Table 1: Mean Pre- and Post-test scores for comparison and training groups (standard deviation in brackets)

Group		Comparison		Training	
Test					
DOLCH	Pre	105.3 (50.0)		101.9 (56.3)	
	Post	115.6 (50.1)		133.6 (41.3)	
			R.A.		R.A.
ACER	Pre	27.3 (10.8)	6-0	24.0 (10.8)	6-0
	Post	27.6 (10.0)	6-3	37.0 (7.0)	6-6
NEALE	Pre	5.6 (3.5)	7-1	5.9 (3.4)	7-1
	Post	6.0 (4.1)	7-1	9.4 (3.7)	7-6

(R.A. equivalent reading age in years and months)

The training group was given a second post-test 10 weeks later at the end of the first school term, and 26 weeks after the beginning of the program.

An analysis of variance with repeated measures showed significant gains on retest scores on all three tests (ACER: $F(3,36)=27.47$, $p < .01$, DOLCH: $F(3,36)=46.97$, $p < .01$, NEALE: $F(3,36)=10.93$, $p < .01$). Therefore, significant gains were made on all three tests, with further gains made over the next school term. Results are presented in table 2.

Table 2: Mean Scores on Pre- and Post-tests for Training Group (standard deviation in brackets)

Test		DOLCH	ACER		NEALE	
	Weeks			R.A.		R.A.
Pre	0	90.8 (52.9)	20.9 (13.3)	6-0	5.9 (3.2)	7-1
Post	4	114.9 (51.4)	29.6 (13.1)	6-3	8.0 (3.9)	7-4
Post(2)	14	137.6 (52.2)	36.4 (11.7)	6-6	10.2 (2.9)	7-10
Post(3)	26	155.9 (50.0)	40.9 (12.3)	6-9	11.0 (4.7)	8-2

(R.A. equivalent reading age in years and months)

CLOZE PROGRAM

Subjects:

Two groups of 10 and 12 children were referred to the Clinic by remedial reading teachers and school counsellors for the cloze program. Chronological ages ranged from 7 years and 8 months to 13 years and 4 months and IQs were in the average to superior range (IQ> 85). Children's sight vocabulary (ACER) ranged from 6 years to 8 years, 6 months. The children were pre-tested and post-tested on the ACER sight vocabulary test, the Edinburgh Reading Test (Stage 1: Section D - Comprehension) and a Cloze Test. Group 1 was re-tested 12 and 32 weeks after the beginning of the program to establish if there were any long term gains. Group 2 was re-tested 12 weeks after the first test.

Instructional Procedure:

The children received a total of five hours of computer-based instruction over a period of five weeks (three individual 20 minute sessions weekly). A series of graded stories was displayed in passages on the screen. Each passage had one word missing and the child selected the correct word from four alternatives displayed at the top of the screen. The child could have any word on the screen 'spoken' by the computer by pressing the 'help' position, followed by the word. The child proceeded to the next passage if correct, or after the computer indicated the correct answer following four incorrect tries. Feedback was given via computer speech after each

response. If the choice was correct the computer responded "Good Work" and the correct word was written in the gap. If an incorrect response was chosen the child was told to read the sentences again. After a second incorrect response the alternatives and the passage were 'read' to the child, with an asterisk marking each word as spoken. If a third error occurred, the sentence was 'read' with the correct word spoken in the gap. Finally, if four consecutive errors were made, the correct word was written in the gap and the full paragraph read. The child proceeded to the next set of passages in the following session if the error rate was below 30 per cent. If the error rate was above 30 per cent the set of passages was repeated in the following session.

Results:

The first experimental group of ten children was re-tested at the end of the five week training session, eight weeks later at the beginning of the next school year and thirty-two weeks after the start of the training program. One child in the first group was not re-tested after the first post-test. T-Tests showed a significant gain in sight vocabulary and comprehension over the training period. There was an increase in mean cloze scores but the difference was not significant. Results are presented in Table 3.

Table 3: Mean Pre- and Post-test scores and T scores.

Test		Mean	SD	T Score	DF	Probability
Sight	Pre	38.2	12.9	-2.50	9	0.03
Vocabulary	Post	42.6	16.3			
Cloze	Pre	9.9	6.1	-1.70	9	n.s.
	Post	12.0	4.8			
Comprehension	Pre	4.8	4.3	-2.98	9	0.02
	Post	7.4	6.6			

Significant long term improvements were found. An analysis of variance with repeated measures showed significant gains between the pre-test and final post-test in sight vocabulary; $F(3,24)=11.49$, $p < .01$ and comprehension; $F(3,24)=7.34$, $p < .01$. There was an increase in mean cloze scores but the difference was not significant. Mean scores for Group 1 are presented in Table 4.

Table 4: Mean Scores on Pre- and Post-tests
Cloze Group 1. (Standard deviation in brackets)

Test	Week	Sight Vocabulary		Comprehension	Cloze
			R.A.		
Pre	0	39.9 (12.4)	6-6	5.3 (4.2)	10.6 (6.1)
Post	5	44.2 (10.4)	6-9	8.2 (6.3)	12.3 (5.1)
Post(2)	12	42.8 (17.0)	6-9	10.0 (7.8)	12.0 (4.5)
Post(3)	32	51.8 (17.2)	7-0	10.4 (7.6)	13.4 (6.2)

(R.A. equivalent reading age in years and months)

Twelve children in Group 2 were re-tested at the end of the five week training session and eight weeks later. A comparison of pre- and post-test scores showed a significant gain in sight vocabulary ($T=-3.81$, $df=11$, $p < .002$), cloze test scores ($T=-1.77$, $df=11$, $p<.05$) and comprehension ($T=-3.08$, $df=11$, $p<.005$). An analysis of variance with repeated measures on test showed significant gains in all three test scores: sight vocabulary ($F(2,22)= 21.02$, $p<.01$), comprehension ($F(2,22)=8.11$, $p<.01$) and cloze scores ($F(2,22)=3.42$, $p<.05$). Results for Group 1 are presented in Table 5.

Table 5: Mean scores on Pre- and Post-tests
Cloze group 2. (Standard deviation in brackets)

Test	Week	Sight Vocabulary R.A.	Comprehension	Cloze
Pre	0	47.1 (14.1) 6-9	9.5 (5.3)	12.3 (4.6)
Post(2)	5	54.5 (14.9) 7-3	12.1 (6.2)	13.8 (3.7)
Post(3)	12	58.1 (14.0) 7-3	12.5 (5.3)	14.7 (5.2)

(R.A. equivalent reading age in years and months)

Discussion:

The results show marked improvements in reading following a relatively short period of time interacting with the computer. An important feature of the computer-based instruction is that immediate feedback is received after a response is made, and attention is focussed on the correct answer. In the sight word program, the

immediate feedback received when an error is made, say by pressing 'saw' instead of 'was', focusses the child's attention on task and he/she is able to compare the words and hence discover that the order of letters is important. Feedback received is also consistent. Regular print size and spoken feedback may benefit a child who has had difficulty in shape recognition and helps the child attend to relevant cues.

The children interact with the computer in a relaxed environment, where there is no competition with peers and they can proceed at their own pace. The spoken feedback means the child does not have to rely on the teacher to help with unknown words and is able to work on the task without interruption. The 'help' button in the cloze program, for example means a child is able to independently read a passage, which would otherwise be at his/her frustration level.

A special feature of the hardware is that the children interact with a touch sensitive display screen. Children with learning difficulties often have problems with spelling and handwriting. Responding by simply pressing the screen with their fingers means they are not hampered by a slow written response, and there is no frustration in learning to use a keyboard or having to correctly spell and type answers, as with many previous computer-based programs. A child therefore is more likely to experience success in the task.

Many features of written language may also be discovered by a child interacting with the programs. One of these features is an awareness of left to right progression in written language. The child interacting with the cloze program observes an asterisk marking the words on the screen as they are spoken, following the left to right progression across a page. The child also sees words written across the top of the screen from left to right when constructing sentences. The relationship between spoken words and print can be discovered, and words can be identified as separate units in written language. In constructing sentences or deciding which word fits in the gap, the child must utilize a large number of cues from a variety of sources, and can discover for him/herself many features of written language.

Feedback from parents of participating children and class teachers was positive. Class teachers were sent a questionnaire, asking for a rating of any changes in a child's reading behaviour relative to his/her 'normal' rate of progress. Changes in a child's reading behaviour and attitudes in the classroom were highlighted in increased interest and motivation to read and in improvements in self-confidence (- in both the child's self-concept and confidence in his/her ability to read). Some children have started to take books home to read (where they previously didn't), or started visiting the local library. Teachers also observed that children now have more enthusiasm and read more often for enjoyment. The improved self-concept stems from experiencing success in an area of previous failure. Correspondingly, attitudes towards reading became more positive. One child chose more difficult books, which indicated he

was less worried about the prospect of having difficulty and possibly making mistakes.

Reading skills also showed a corresponding improvement in the classroom. Children involved in the sight word program showed improvements in sight word skills. Other skills that teachers noted improved in the classroom included better left to right directionality, children becoming more conscious of print, noticing more words around them, and being more conscious of letters and sounds that make up a word (even though no direct training was given in this area). Reading also became more fluent. Teachers saw children from the cloze programs as being more aware of reading for meaning and being able to make better use of contextual cues (e.g. being able to guess 'bigger' words from context). A major discovery made by one child was that he did not have to be able to read all the words to be able to obtain meaning. For example; previously when he read aloud and was confronted with a word he didn't recognize he would develop a 'mental block' and become upset. By the end of the passage he had reached a point where he couldn't read words like 'the', 'of', and 'but'. Now, however, he mumbles "I don't know that word" and happily reads on. He has learnt a useful strategy which can be applied in reading. Therefore, the programs help children develop strategies which they can apply in their classroom reading. Experience at the Clinic strongly suggests that computer-based teaching can be a useful supplement to classroom instruction for children with reading disabilities.

References

Alderman, D., Appel, L.R. and Murphy, R.T. PLATO and TICCIT: An evaluation of CAI in the community college. Educational Technology, 1978, 18, 40-45.

Bateman, B. Teaching Reading to Learning Disabled and other Hard-To-Teach Children. In L. Resnick and P.A. Weaver (Eds), Theory and Practice of Early Reading, Vol 1., Lawrence Erlbaum Ass., 1979.

Clay, M.M. Reading: The Patterning of Complex Behaviour. Heineman Educational Books, Auckland, 1979

Edwards, J., Norton, S., Taylor, S., Weiss, M. and Dusseldorp, R. How Effective is CAI: A Review of the Research. Educational Leadership, 1975, 33, 147-153.

Kearsey, G.P. Some conceptual issues in computer-assisted instruction. Journal of Computer-Based Instruction, 1977, 4(1), 8-16.

Lally, M. Computer-assisted Teaching of Sight-word Recognition for Mentally Retarded School Children. American Journal of Mental Deficiency, 1981, 85(4), 383-388.

Southgate, V. Extending Beginning Reading, Heineman Educational books, London, for the Schools Council, 1981.